RAILROAD GULCH BEST MANAGEMENT PRACTICES EVALUATION: A PAIRED WATERSHED STUDY

Humboldt Redwood™

HUMBOLDT STATE UNIVERSITY

Supported by a grant from the California Board of Forestry Monitoring Study Group

OUTLINE

- PROJECT OVERVIEW
- TEN HYPOTHESES:
  - METHODS
  - CURRENT STATUS
- CONCLUSIONS

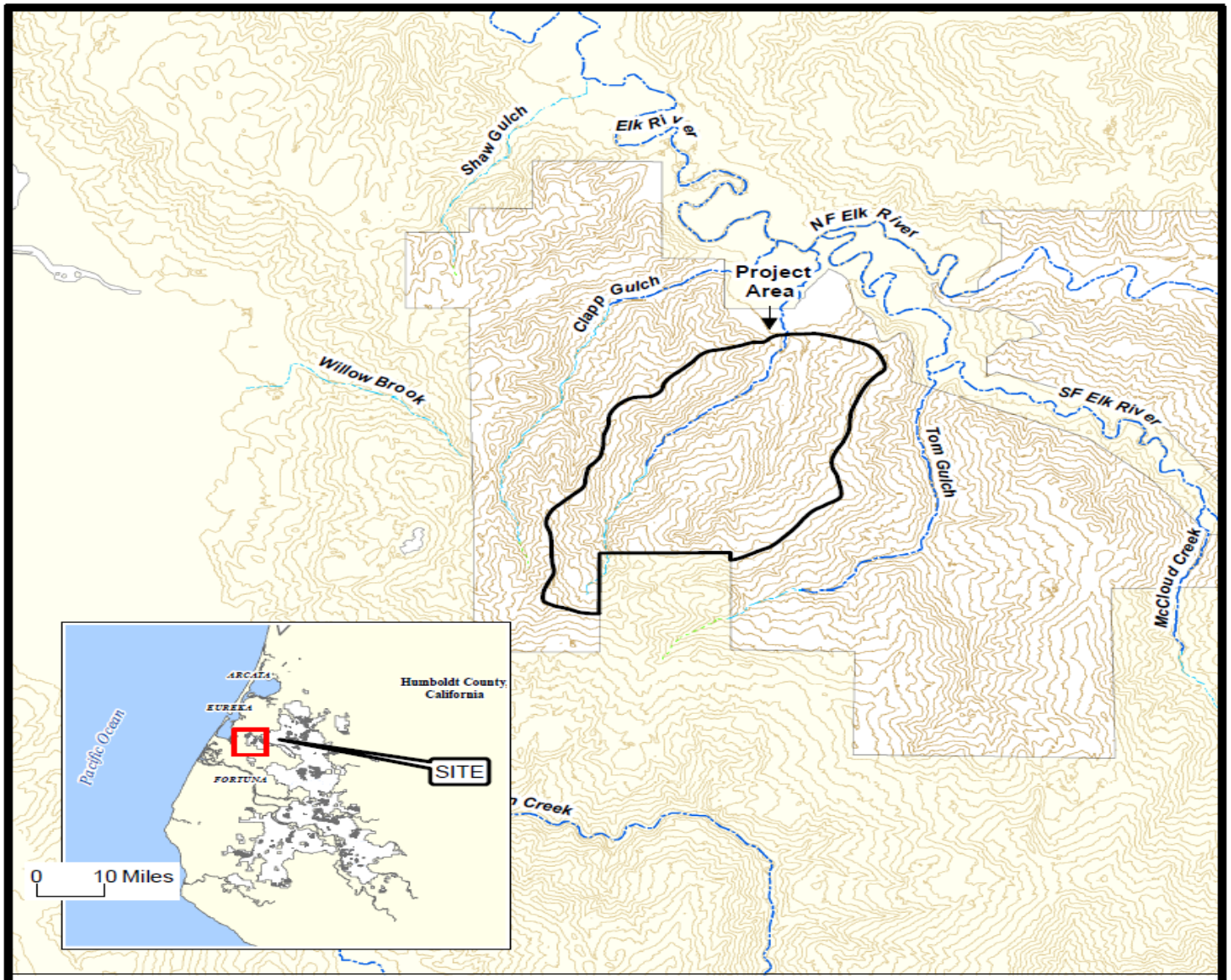
- ANDREW STUBBLEFIELD, ASSOCIATE PROFESSOR, HUMBOLDT STATE UNIVERSITY
- SHANE BEACH, GEOLOGIST, HUMBOLDT REDWOODS CO
- NICK HARRISON, HYDROLOGIST, HUMBOLDT REDWOODS CO
- LEE MACDONALD, EMERITUS PROFESSOR, COLORADO STATE UNIVERSITY
- MIKE MILES, FORESTER, HUMBOLDT REDWOODS CO
- MICHELLE HASKINS, GRADUATE STUDENT, HUMBOLDT STATE UNIVERSITY

GOAL

- Evaluate the effectiveness of:
  - Humboldt Redwood Company's (HRC) Habitat Conservation Plan (HCP)
  - California Forest Practice Rules
  - Elk River Watershed Analysis-derived prescriptions
- in minimizing sediment delivery to watercourses in response to timber harvest activities

OBJECTIVES

- Integration of Compliance And Effectiveness Monitoring
- HRC's HCP requires monitoring to evaluate the effectiveness of timber harvest prescriptions in preventing the delivery of management-related sediment to watercourses
- Monitoring requirements include implementation of a Best Management Practices Evaluation Program (BMPEP) (HCP §6.3.5.1.3) and Instream Effectiveness Program (HCP §6.3.5.2)



Legend

Land Ownership

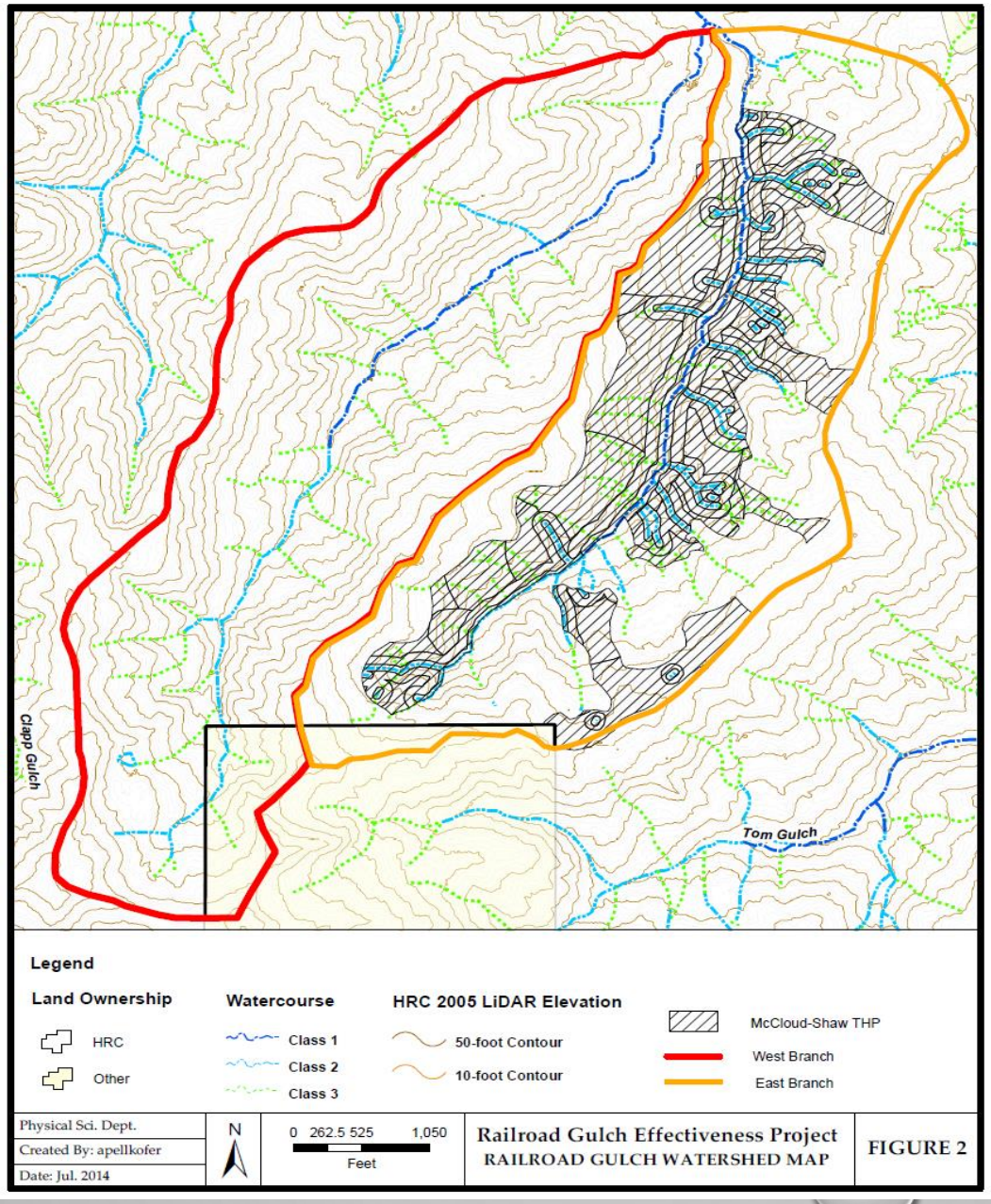
- HRC
- Other

Watercourse

- Class 1
- Class 2

HRC 2005 LiDAR Elevation

- 50-foot Contour
- 10-foot Contour


Clapp Gulch
Tom Gulch
Legend
Land Ownership
HRC
Other
Watercourse
Class 1
Class 2
Class 3
HRC 2005 LiDAR Elevation
50-foot Contour
10-foot Contour
McCloud-Shaw THP
West Branch
East Branch
Physical Sci. Dept.
Created By: apellkofer
Date: Jul. 2014
N
0 262.5 525 1,050
Feet
Railroad Gulch Effectiveness Project
RAILROAD GULCH WATERSHED MAP
FIGURE 2

RAILROAD GULCH

- West branch is 366 acres, East branch is 317 acres
- Initial clear-cutting and railroad harvesting including the use of ‘steam donkeys’ in the early 1900’s
- Densely restocked
- Selection and even-aged harvest between 1987 and 2002
- 85% redwood, 12% Douglas-fir, 2% grand fir and 1% red alder. Stands are primarily single tiered and even aged
- Middle to late Pleistocene aged Hookton formation and Miocene to late Pliocene aged undifferentiated Wildcat sediments
- Highly erosive and subject to both shallow and deep-seated mass movements

MCCLOUD SHAW THP

- 80 acres of single tree selection
- 45 acres of group selection
- 24 acres of no harvest
- 4 acres of ridge top new road construction right-of-way harvest necessary for the construction of approximately 2,750 feet of new seasonal road
- Cable yarding (114 acres)
- Ground-based equipment (15 acres)

TIMELINE

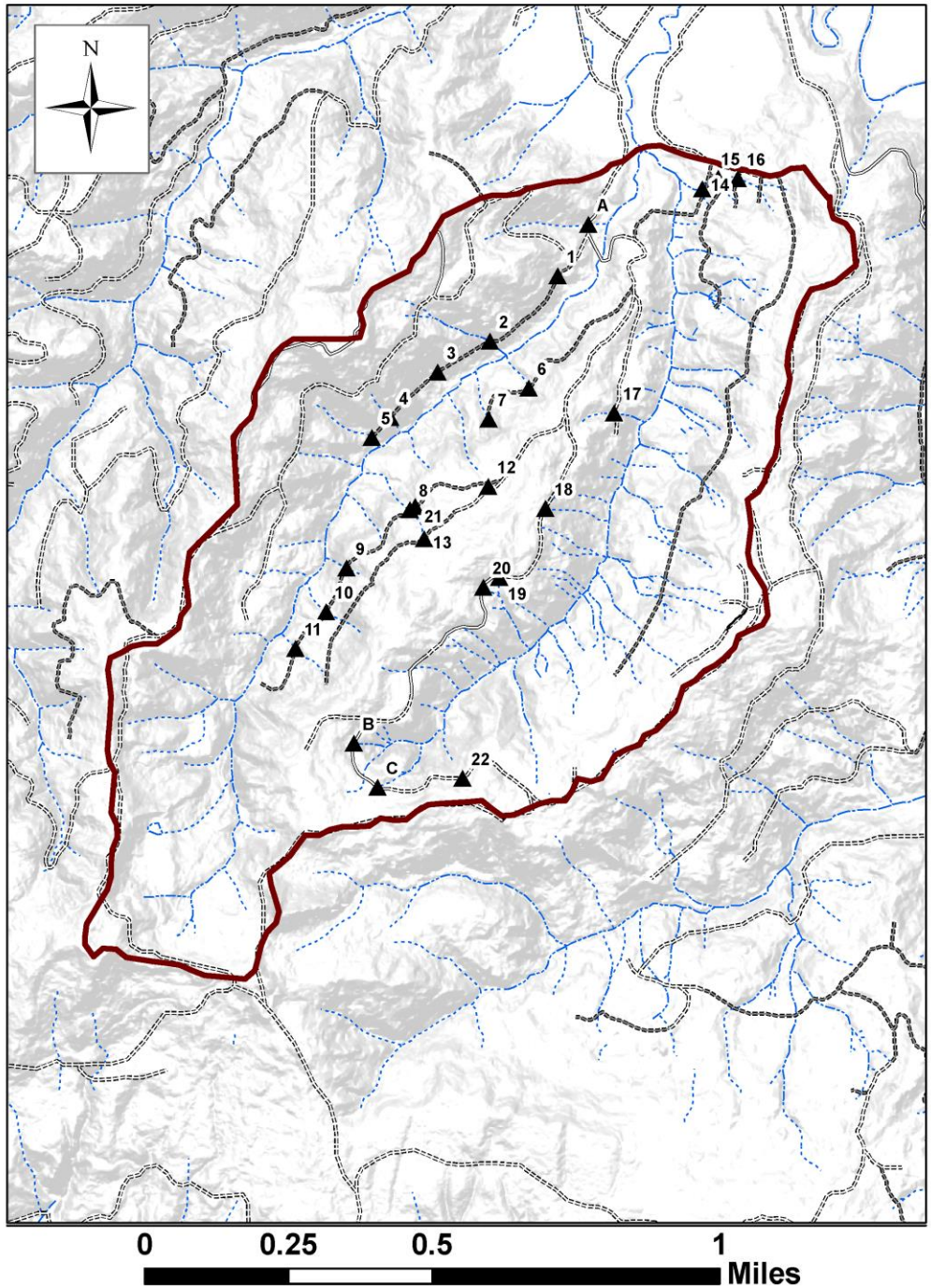
- Monitoring WY 2014 - 2019
- Road construction and upgrading -summer of 2015
- Harvest -summer of 2016
- Annual reporting. WY 2014-2015 report just released
- 2 masters theses 2017, 2019
- Peer-reviewed publication 2019

HYPOTHESIS 1

Properly implemented BMPS for new or reconstructed road stream crossings will not increase watercourse turbidity directly below the crossing by greater than 20%.

Method: Grab sampling during storm events

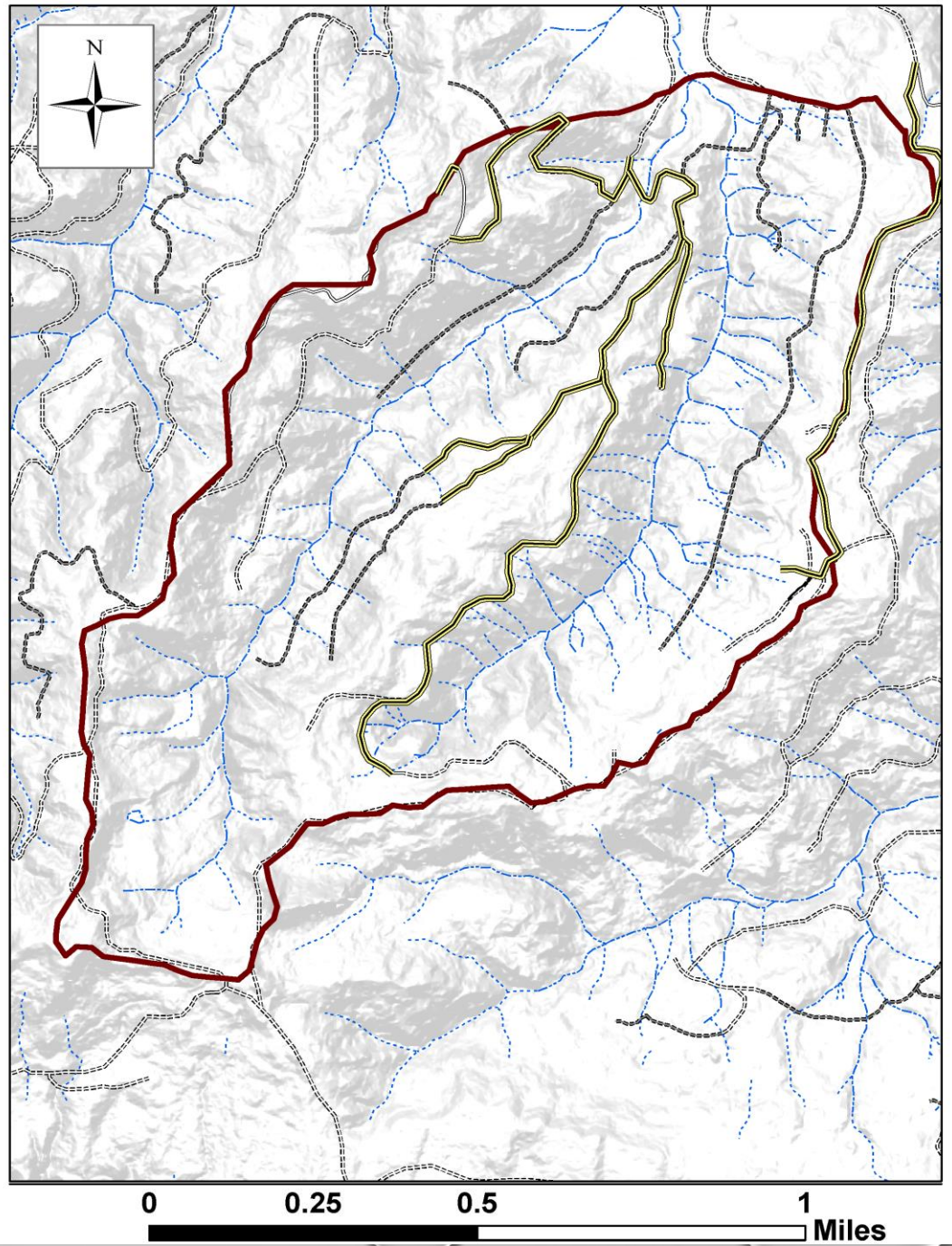
Sites 17-20,22 (A,B,C)



HYPOTHESIS 2

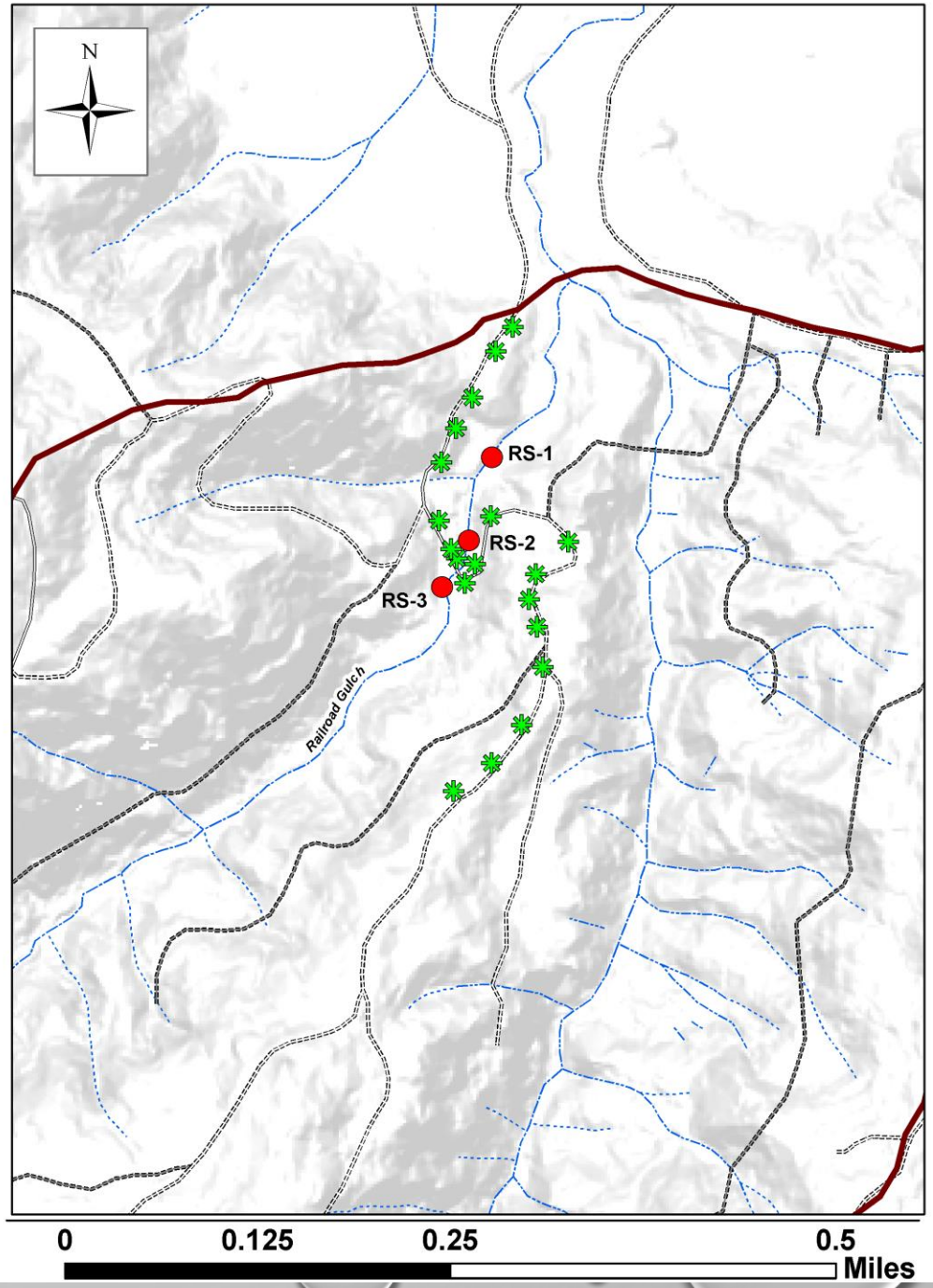
Properly implemented sediment-related BMP's on THP-related road segments are effective in preventing road surface erosion and related sediment delivery to watercourses.

Method: Annual road surveys evaluate erosion and hydrologic connectivity



HAUL ROAD IN CONTROL WATERSHED

- Showing locations of erosion control wattles



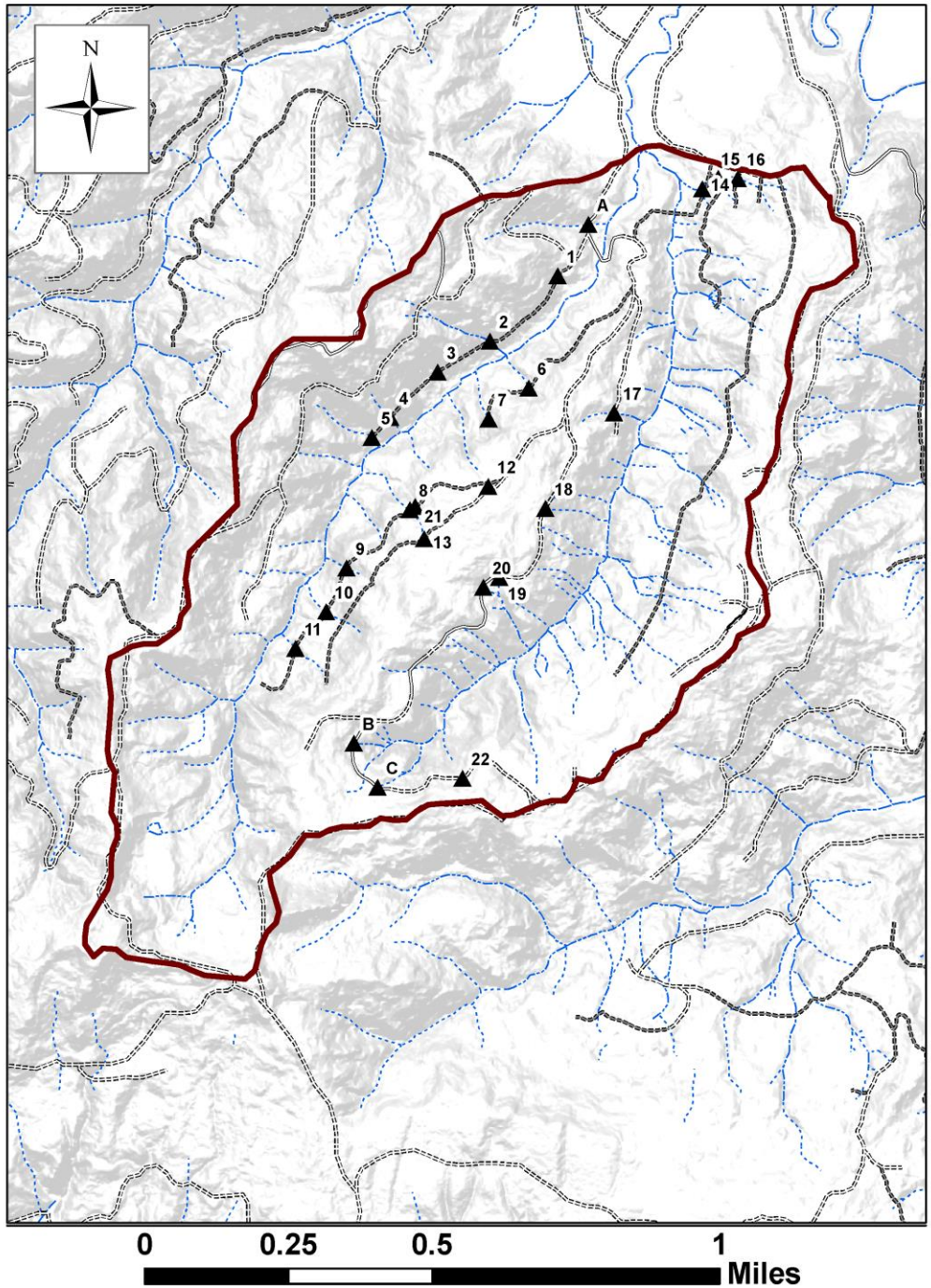
HYPOTHESIS 3

Existing untreated Humboldt crossings have less erosion than treated ones.

Method: Annual inspection and grab sampling during storm events

Sites 1-16, 21

Debris torrent at #11 on 2/6/15



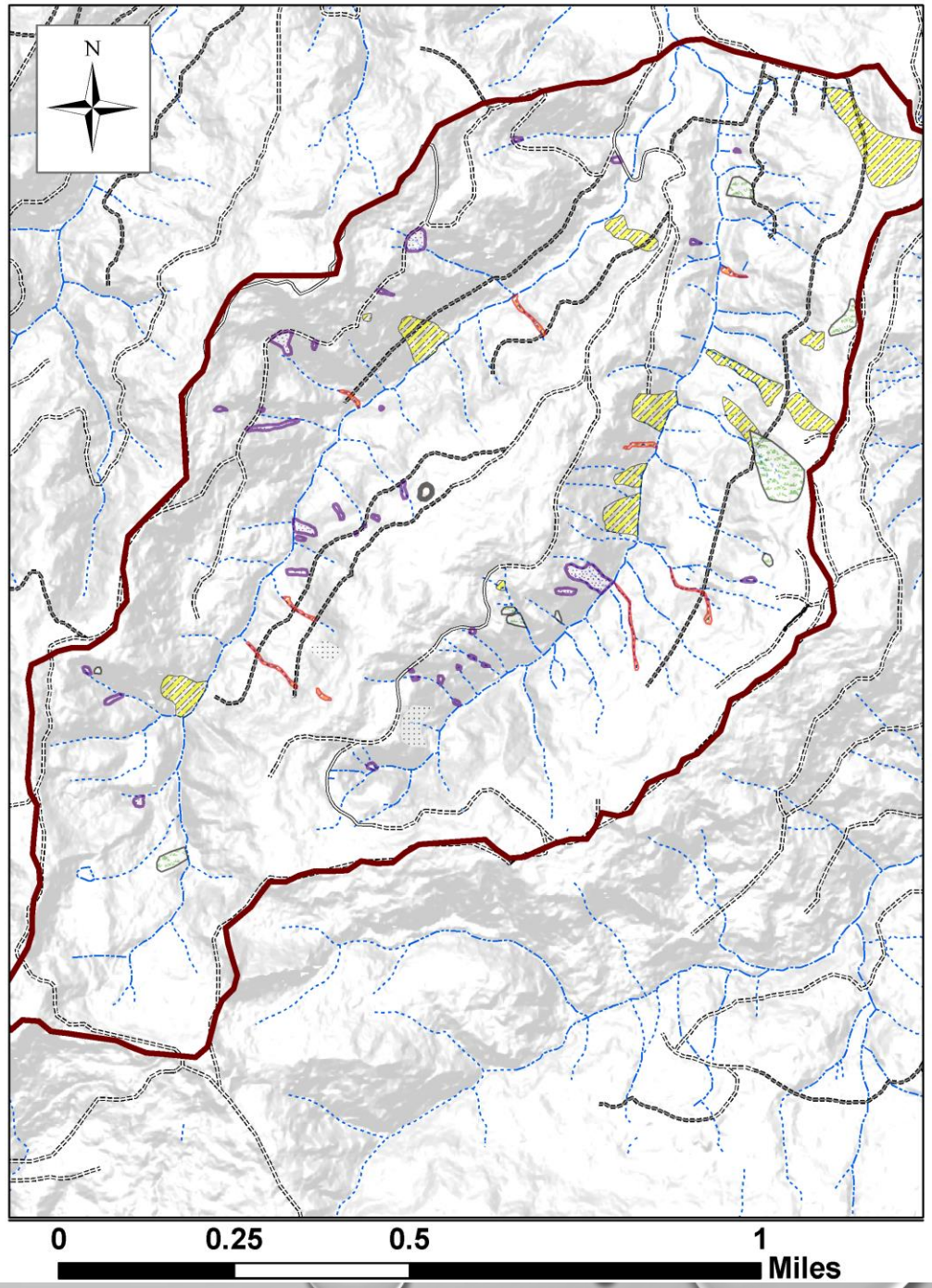
- FEB 2015 REACTIVATION OF 41 SLIDES

HYPOTHESIS 4

No observed increase in the rate of landslides or landslide-related sediment delivery to watercourses originating from harvested areas within 10 years following harvest

No landsliding will occur from within or immediately adjacent the unit in areas not previously identified as unstable.

Method: Annual aerial photography and field inspection

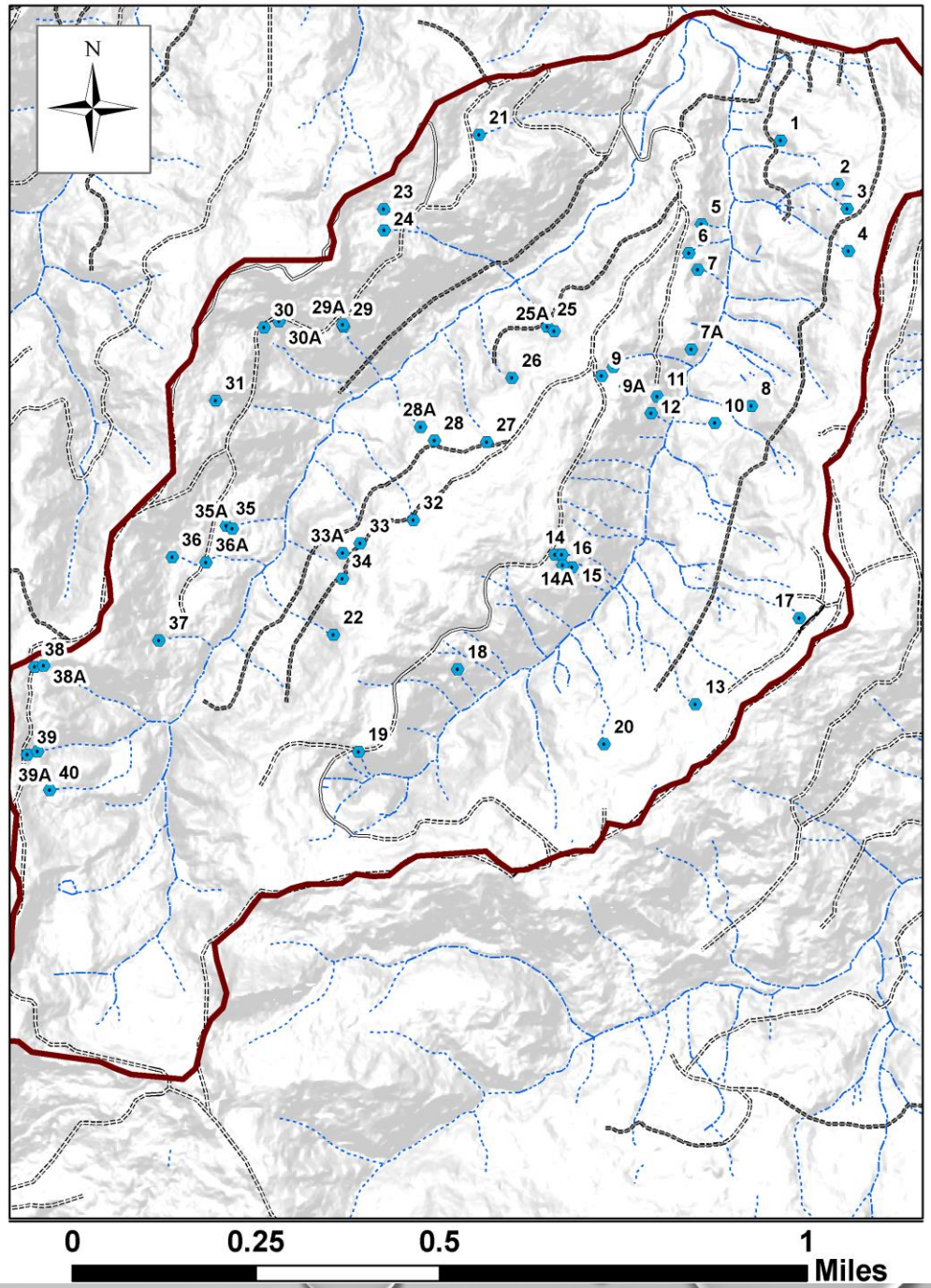


HYPOTHESIS 5

Rate of retreat of channel initiation points at the head of watercourses from the East branch will not migrate upslope at a faster rate compared to the West branch, after treatment.

Methods: annual survey

Status: Stable

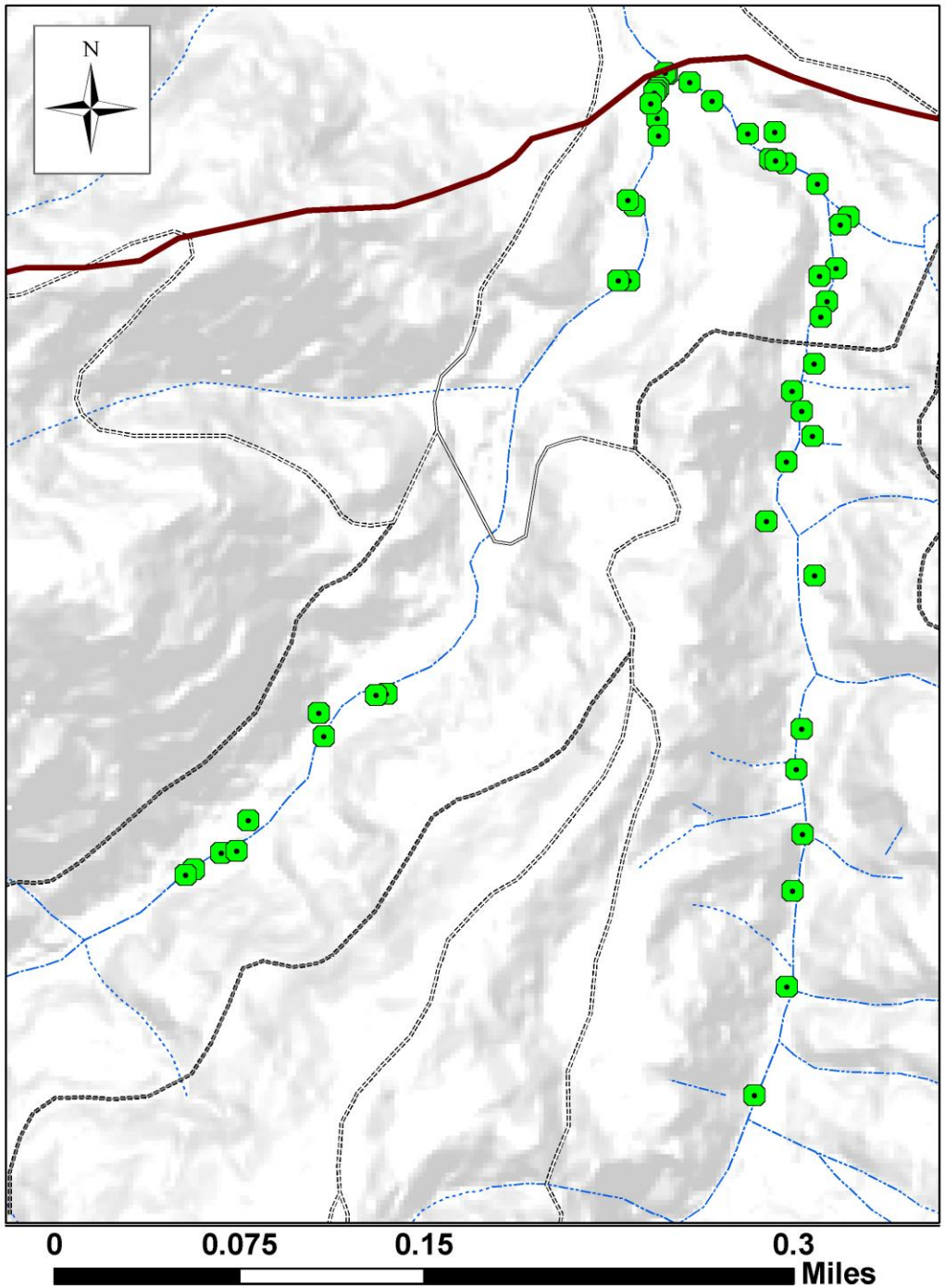



29

HYPOTHESIS 6

Number, area, and activity of small streamside landslides (SSLs) in the East Branch will not increase during the 3 years following harvest in comparison to the control basin.

Methods: Annual field inspection



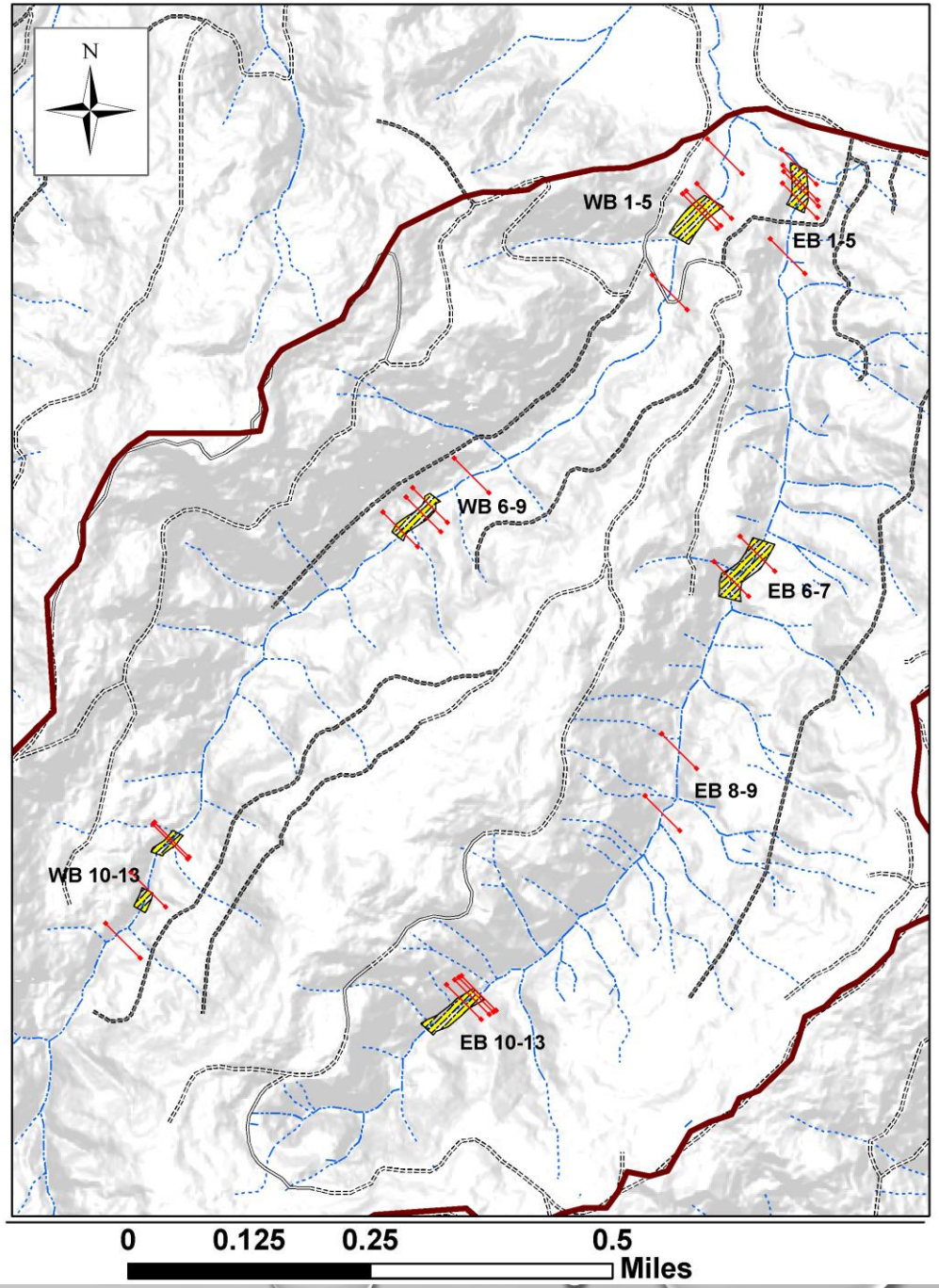
STREAMSIDE LANDSLIDES

	East Branch		West Branch	
Water Year	Displacement (yd^3)	Delivery (yd^3)	Displacement (yd^3)	Delivery (yd^3)
2013	6.0	6.0	11.4	11.2
2014	0.3	0.3	0.6	0.6
2015	8.8	8.8	20.5	12.8

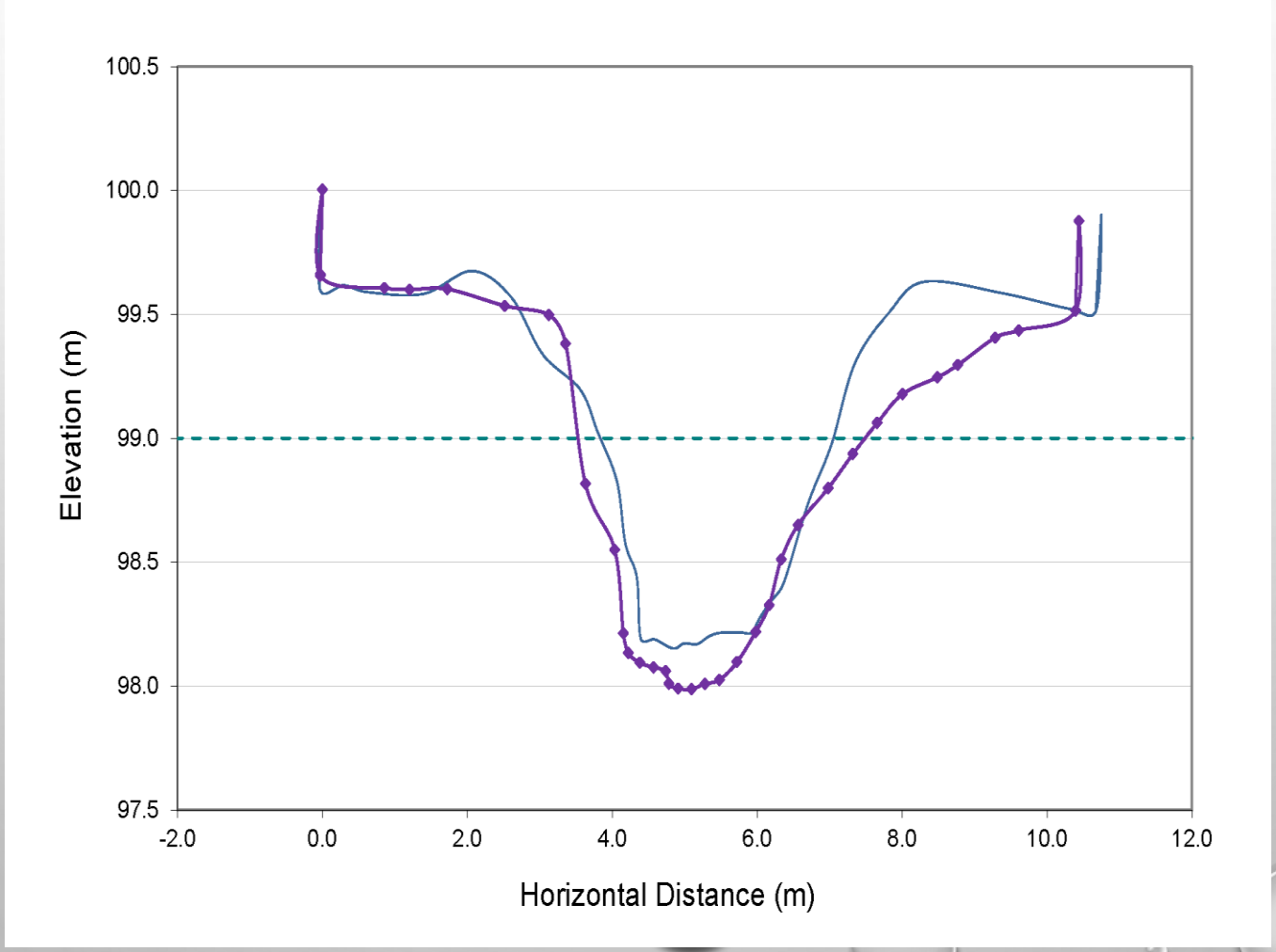
HYPOTHESIS 7

Mean change in bankfull area from each set of cross sections should not significantly differ (>8%) between the East Branch and the West Branch.

Methods: Cross sections established in three locations per branch, surveyed annually. Pebble counts.



CROSS SECTION EB-4



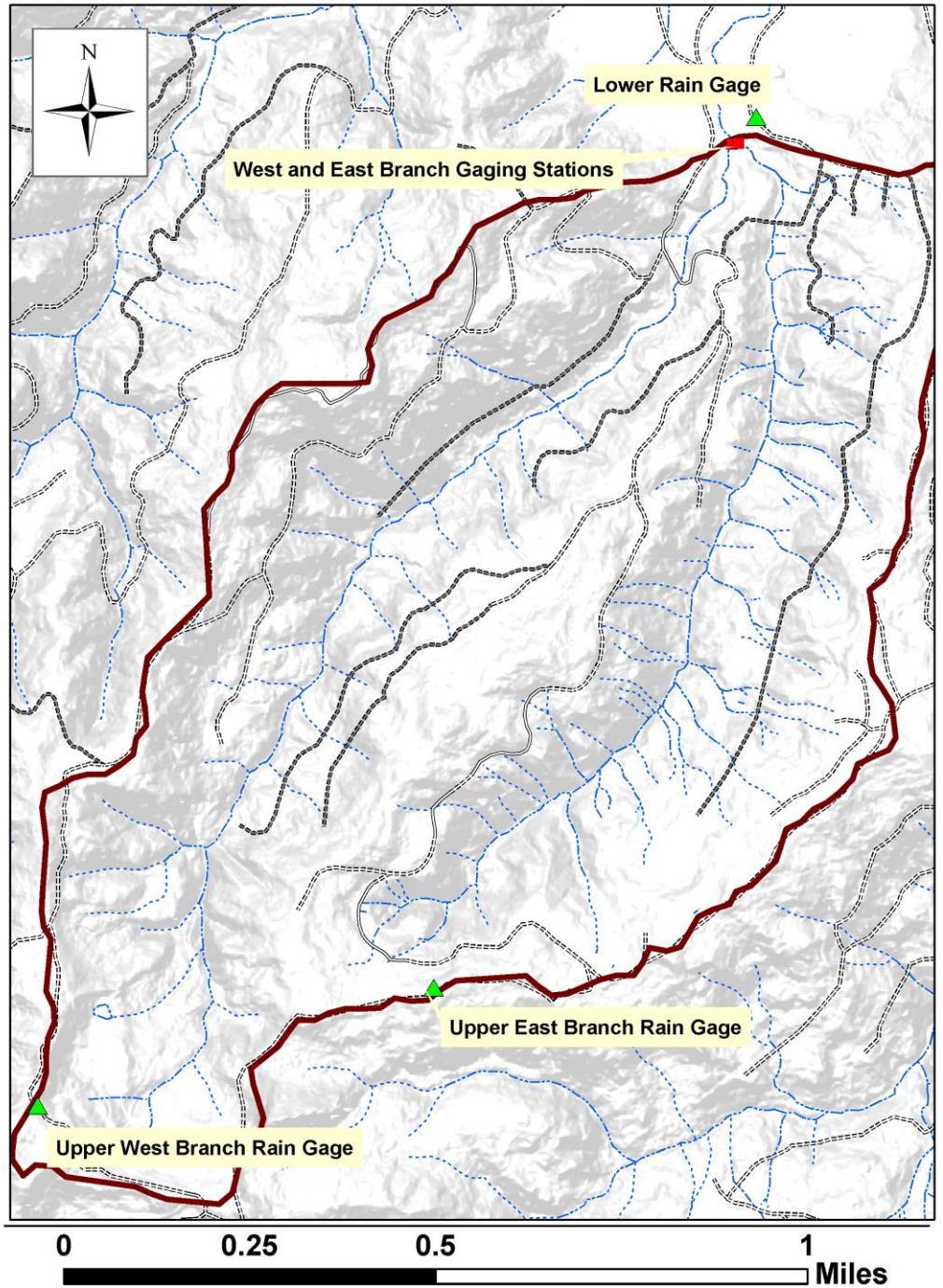
HYPOTHESIS 8

Post-harvest turbidity and suspended sediment yield within the East Branch will not increase compared to the West Branch following implementation of the McCloud-Shaw THP.

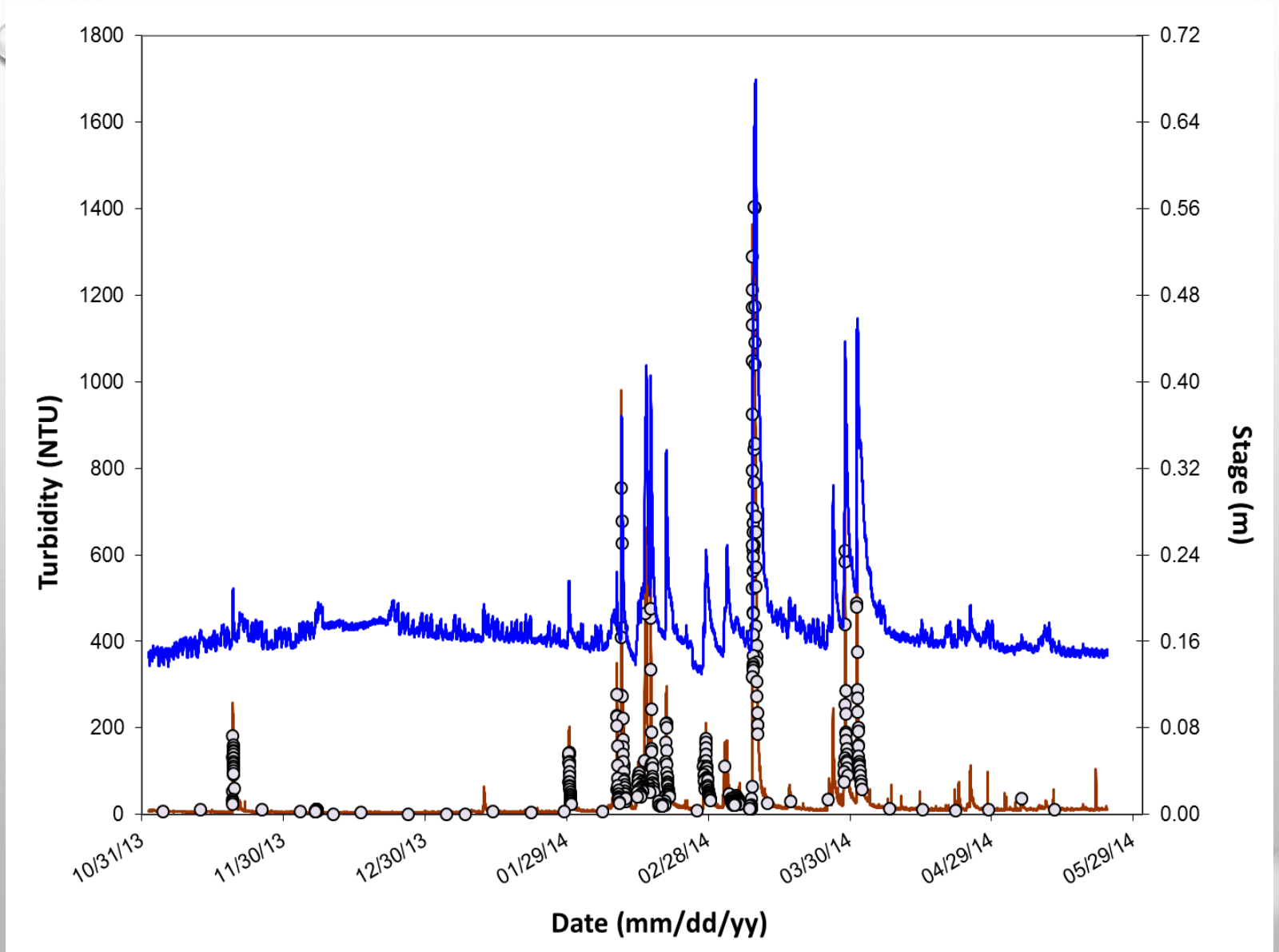
Methods: Continuous turbidity, discharge, and autosampler station maintained at outlet of each branch

- Annual sediment loads calculated
- Rain gauges in each branch and confluence

Grab samples taken during storm events from main stem and tributaries for turbidity

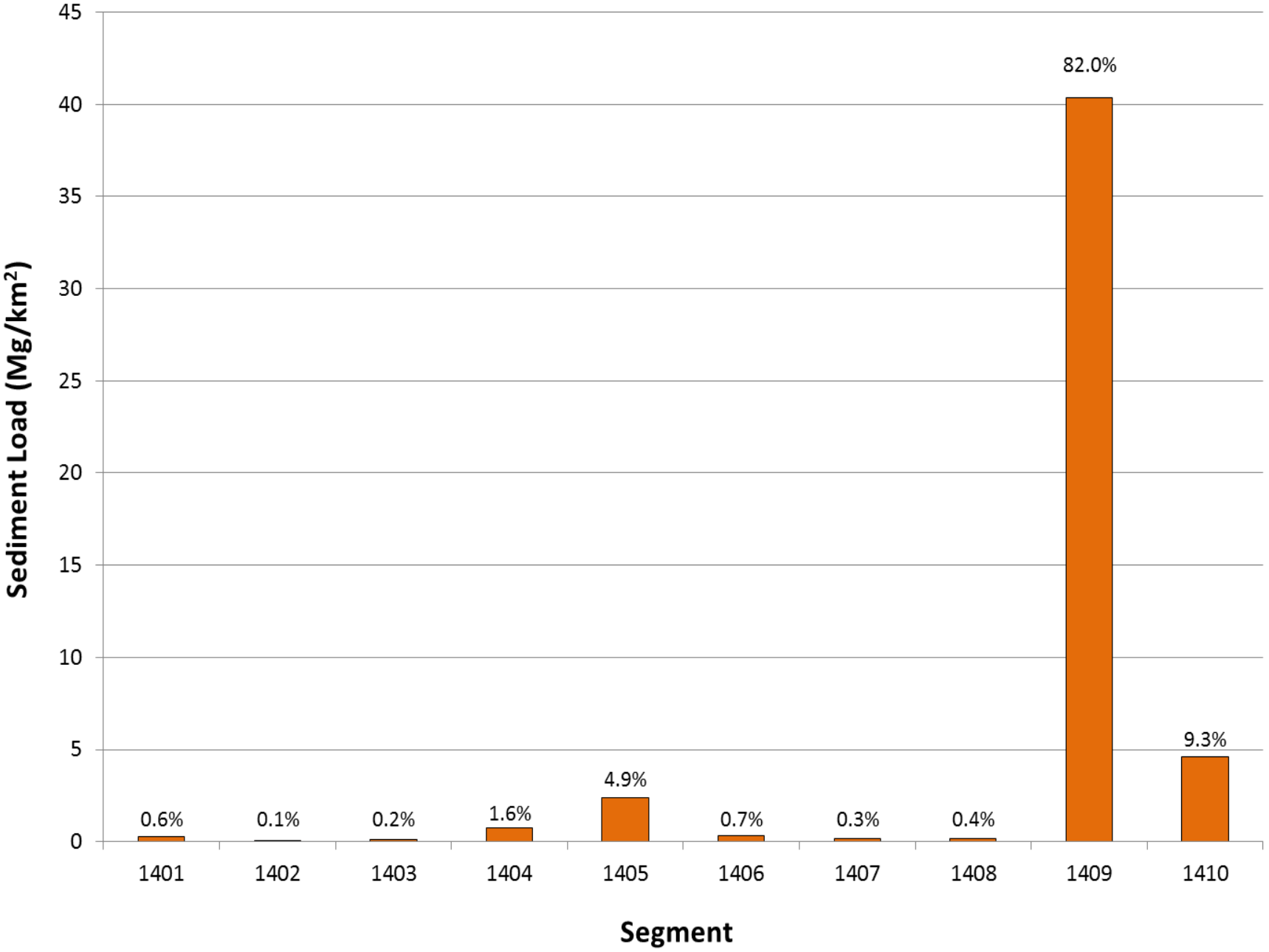


2014 EAST BRANCH

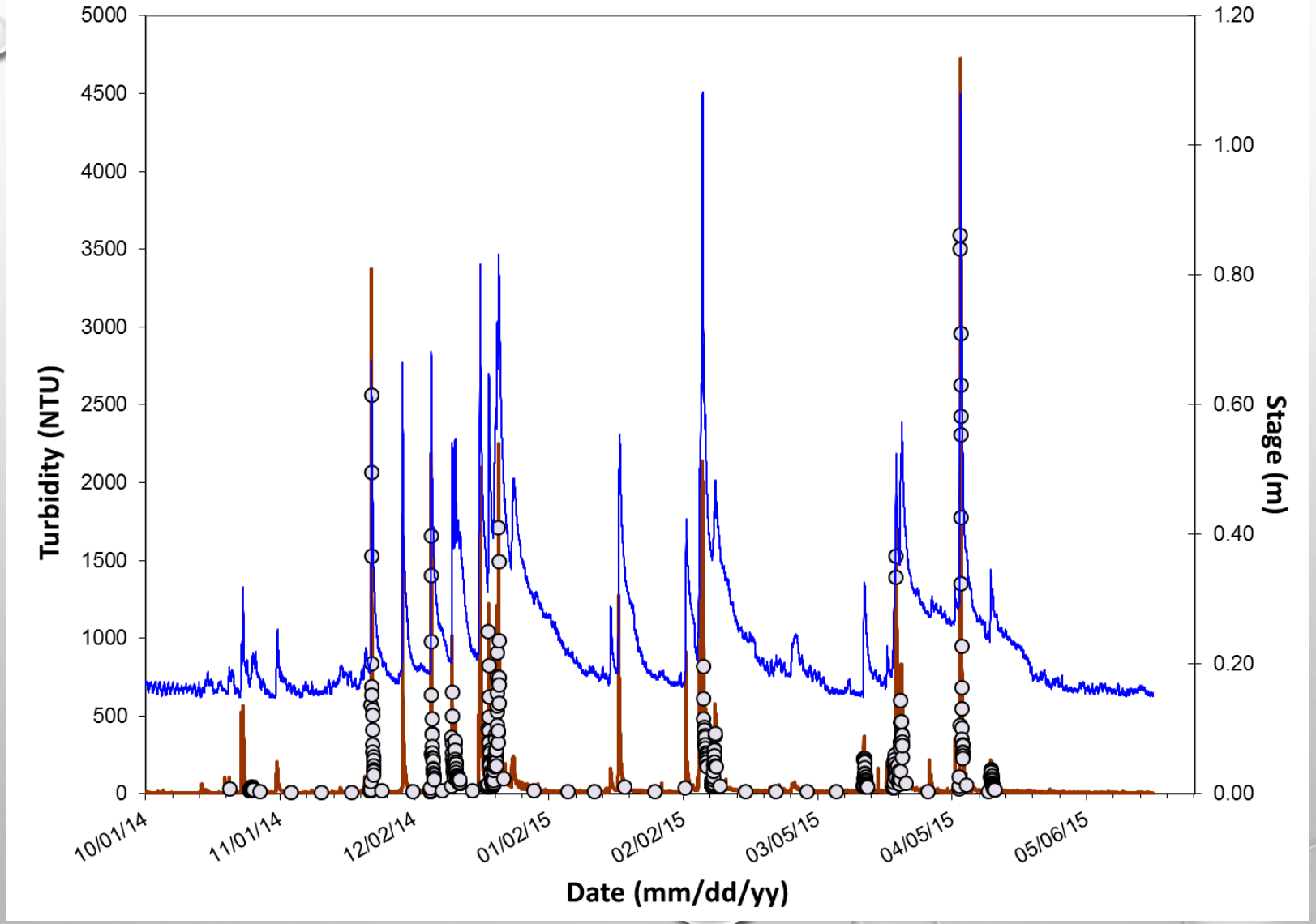


Hydrologic Statistics for WY 2014 Railroad Gulch, Elk River, CA.

Station	Drainage Area (km^2)	Sediment Load (Mg)	Sediment Yield (Mg/km^2)	% Time Turbidity >25 NTU	Mean Discharge (m^3/s)	Peak Discharge (m^3/s)	Peak Discharge ($m^3/s/km^2$)
East	1.28	63	49	16%	0.01	0.42	0.33
West	1.48	57	38	15%	0.01	0.36	0.24

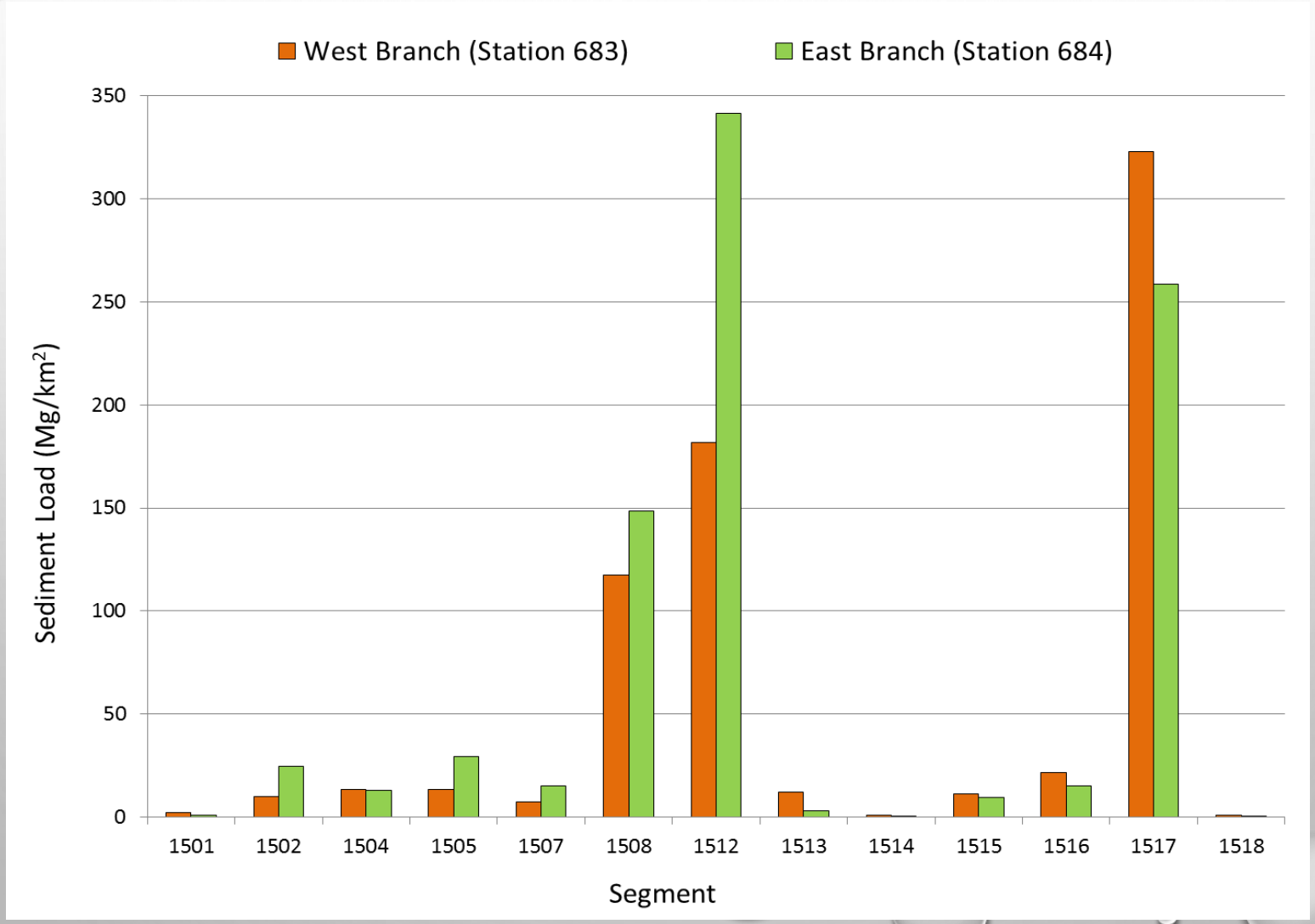

45
40
35
30
25
20
15
10
5
0
Sediment Load (Mg/km²)
82.0%
9.3%
4.9%
1.6%
0.6%
0.1%
0.2%
0.7%
0.3%
0.4%
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
Segment

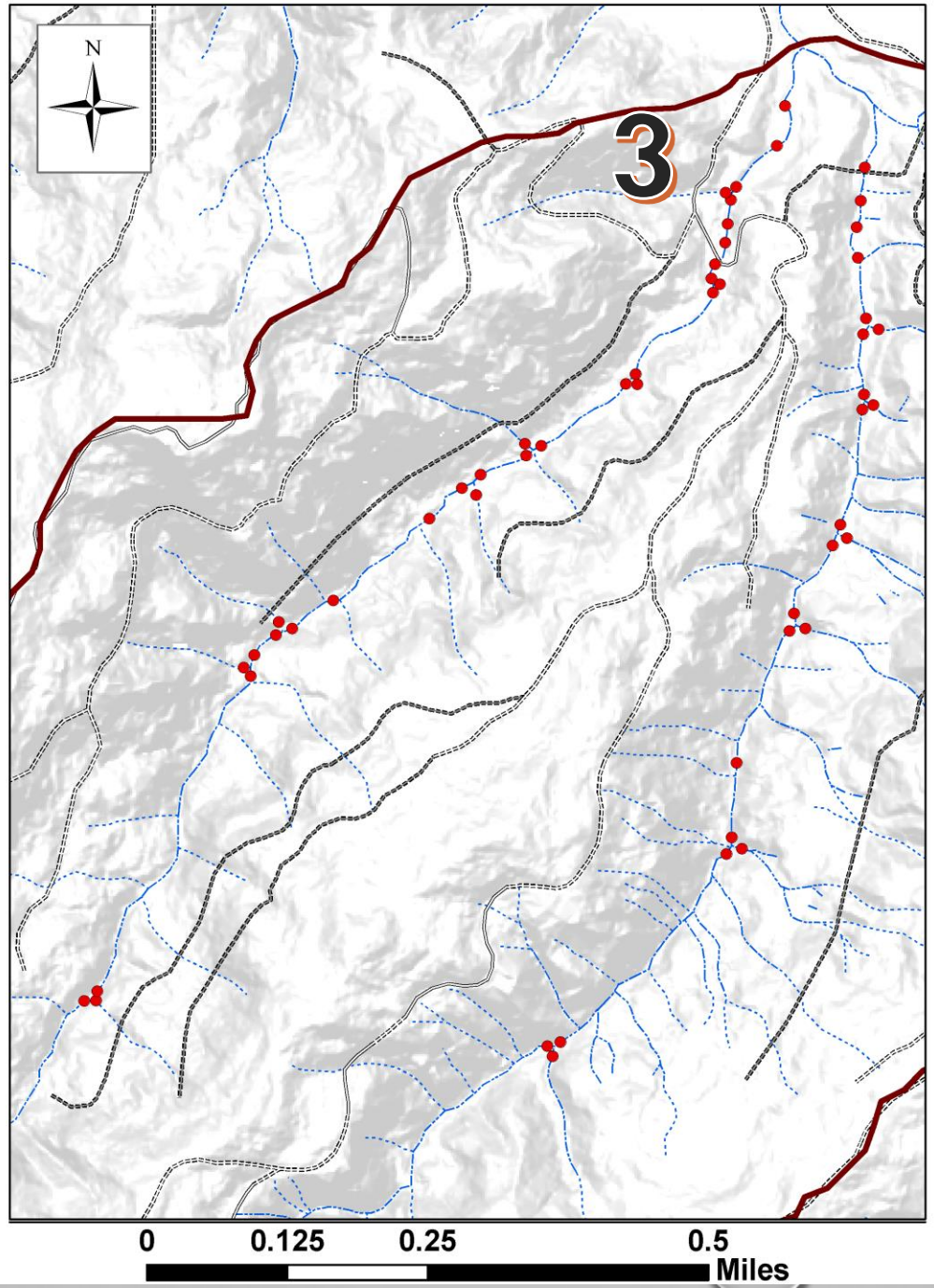
2015 EAST BRANCH



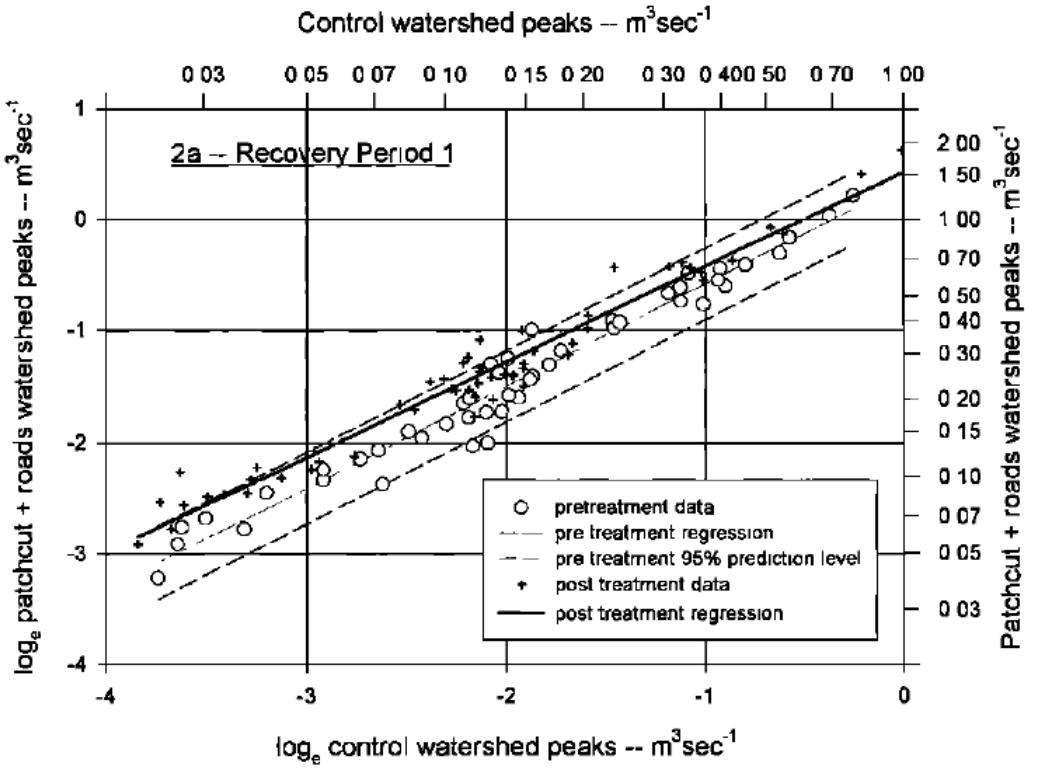
HYDROLOGIC STATISTICS FOR WY 2015 RAILROAD GULCH, ELK RIVER, CA.

Station	Drainage Area (km^2)	Sediment Load (Mg)	Sediment Yield (Mg/km^2)	% Time Turbidity >25 NTU	Mean Discharge (m^3/s)	Peak Discharge (m^3/s)	Peak Discharge ($m^3/s/km^2$)
East	1.28	1102	861	28%	0.03	1.6	1.2
West	1.48	1060	716	30%	0.04	2.0	1.3


West Branch (Station 683)
East Branch (Station 684)
Sediment Load (Mg/km²)
350
300
250
200
150
100
50
0
1501
1502
1504
1505
1507
1508
1512
1513
1514
1515
1516
1517
1518
Segment


N
3
5
0
0.125
0.25
0.5
Miles

HYPOTHESIS 9



Post-harvest peak flows within the East Branch will not increase compared to the West Branch following implementation of the McCloud-Shaw THP.

Methods: Continuous discharge stations. A) Caspar Creek Equation generates estimate of peak flow alteration, which is then compared to observed changes. B) Regression of peak flow relationship between branches before and after treatment.

HYPOTHESIS 10

Current erosion rates measured over the study period are within 20% of long term erosion rates as determined by Be-10 isotope analysis

Method: Field samples analyzed by accelerator mass spectrometry. P. Belmont and K. Ferrier – geologists, will calculate long term rates

CONCLUSIONS

- Multi-year, before/after, paired watershed approach accounts for interannual variability in storm conditions
- Continuous turbidity and discharge and autosampling gives accurate sediment yields
- Extensive erosion measurements and grab sampling surveys allow for quantification of road erosion, road crossings, streamside landslides, deep-seated landslides, and channel headcutting
- Watersheds responding in a similar fashion to both dry and wet years
- Methods are working well, we are in a good position to capture post-harvest changes that occur

MORE INFORMATION? FIND THE FIRST ANNUAL REPORT AT THIS ADDRESS:

http://www.bof.fire.ca.gov/board_committees/effectiveness_monitoring_committee_/may_2016_emc/emc_3.0_annual_report_2014-2015_bmp_effectiveness_rr_gulch.pdf

QUESTIONS?